TECHNOLOGY NEEDS/OPPORTUNITIES STATEMENT

SNF SLUDGE STORAGE AND MONITORING SYSTEM

Identification No.: RL-SNF14
Date: October 2001

Program: Spent Nuclear Fuels (SNF)
OPS Office/Site: Richland Operations Office/Hanford Site
PBS No.: RL-RS03
Waste Stream: RL-HLW-21, SNF Basin Sludge
TSD Title: N/A
Operable Unit (if applicable): N/A
Waste Management Unit (if applicable): N/A
Facility: K-Basin

Priority Rating:

This entry addresses the "Accelerated Cleanup: Paths to Closure (ACPC)" priority:
____ 1. Critical to the success of the ACPC
_X__ 2. Provides substantial benefit to ACPC projects (e.g., moderate to high life-cycle cost savings or risk reduction, increased likelihood of compliance, increased assurance to avoid schedule delays)
____ 3. Provides opportunities for significant, but lower cost savings or risk reduction, and may reduce uncertainty in ACPC project success.

Need Title: SNF Sludge Storage and Monitoring System.

Need/Opportunity Category: *Technology Opportunity* -- The site desires an alternative to the current baseline technology.

Need Description: The K-Basin's sludge (~52 m^3) needs to be removed from the K Basins prior to decontamination and decommissioning (D&D). The sludge, which contains some reactive metal uranium fuel fragments, needs to be retrieved, and placed in appropriate vessels for shipment to and interim storage at T-Plant. Ultimately, the sludge will be treated and dispositioned to WIPP. A cost effective method and supporting technical basis and safety analysis is needed so that the sludge can be easily and safely stored and monitored before sludge treatment and disposition to WIPP.

Schedule Requirements: The sludge needs to be removed from K Basins prior to August 2004 to comply with the Tri-Party Agreement milestone pertaining to removal of sludge and debris. Initial operation is scheduled for the end of December 2002.

Problem Description: Metallic uranium Spent Nuclear Fuel (SNF) currently is stored in two water-filled concrete pools, 105-KE Basin (KE Basin) and 105-KW Basin (KW Basin), at the United States Department of Energy (U. S. DOE) Hanford site. These fuel storage pools also contain sludge containing hazardous substances that primarily result from the degradation of the SNF. In the past, large quantities of contaminated water leaked from the basins into the underlying soil and groundwater. Because of this, the U.S. Department of Energy-Richland Operations Office has determined that the hazardous substances stored in the basins present a potential threat to human health and the environment, and that a non-time-critical removal action conducted under CERCLA is warranted to reduce this threat. The SNF Project mission includes safe removal and transportation of all sludge from these storage basins to a more secure storage state in the 200 West Area (currently identified as T Plant). The sludge is any material in the K Basins pools that is less than or equal to 0.64 cm (0.25 in.) in diameter and is removed from the basin as a bulk waste. The sludge is a combination of sand, dirt, fuel corrosion products, paint chips, corrosion products from racks and canisters and other hardware in the basins. Some pieces of unoxidized metal fuel or hydride also are likely to be present. Some sludge is contaminated with polychlorinated biphenyls (PCB).

Uranium metal reacts with water liberating hydrogen gas and energy. The rate of this reaction increases exponentially with temperature. Consequently, to maintain thermal stability, the sludge must be transported and stored in systems designed to provide a rate of heat removal that prevents the temperature in the sludge from increasing significantly.

The K Basin sludge will be segregated into two general types (Type I and Type II) based on the expected uranium metal content. The current conceptual design calls for the higher uranium metal content sludge (Type II) to be loaded into vessels, which will be stored in a water –filled pool at T Plant that operates at conditions similar to those at the K Basin Pools. The baseline plan for Type I sludge, which consists primarily of sludge with lower uranium metal content from the K Basins floor and pits, is to load it into vessels and store the vessels in air within T Plant.

Potential Life-Cycle Cost Savings of Need (in $000s) and Cost Savings Explanation: The total cost for retrieval and storage of the sludge is estimated to be $40M. Considerable cost saving could be realized by elimination of the need to store the sludge in water filled pools, establishing an automated monitoring system, and using large commercially available transport and storage containers.

Elimination of the need for the T Plant pool for storage of Type II K Basins sludge may save several million dollars. Use of a smaller number of large, near-commercial vessels (e.g., High Integrity Containers) for storage of K Basin sludge may save several million dollars compared to 10 in. and 24 in. diameter vessels in the current project baseline. The technical issue to be overcome is to provide a technical basis for the safety analysis that can assure thermal stability in the transport/storage container and air storage. Increased characterization knowledge and modeling of critical parameters such as thermal conductivity and uranium metal distribution is required to supports change of the technical baseline.

Deployment of an automated monitoring system may save several million dollars over the baseline plan of weighing the vessels each quarter with a crane and load cell. Furthermore, an automated monitoring system would provide substantial risk reduction by providing early detection of instability within a sludge storage vessel.

These cost savings are based on previous cost estimates and engineering judgment. The accuracy of these savings are probably plus or minus 50%.

Benefit to the Project Baseline of Filling Need: Demonstration of the viability of the use alternate storage methods will simplify design, procurement, and reduce handling requirements. It is expected that the use of a larger volume storage system will provide improvements to the schedule for removing the sludge from the K Basins.

Relevant PBS Milestone: TBD

Functional Performance Requirements: A sludge storage system is necessary that can be loaded remotely in a high-radiation environment, reject heat generated for uranium metal oxidation, preclude segregation of metallic uranium, and allow monitoring to assure that the sludge is covered with a head of water.

Work Breakdown Structure (WBS) No.: TBD

TIP No.: N/A

Justification For Need:

Technical: The K-Basin's sludge must be removed from the basin in order to D&D the facility.

Regulatory: Tri-Party Agreement milestones are as follows:
M-34-08: July 31, 2004, Initiate K East Basin sludge removal.
M-34-10: August 31, 2005, Complete K-Basin's sludge removal.

Environmental Safety & Health: N/A.

Cultural/Stakeholder Concerns: N/A.

Other: None identified.

Current Baseline Technology: Storage of K Basin sludge at T Plant in 10 in. and 24 in. diameter, custom designed storage vessels. The T-Plant Pool will be used for storage of higher uranium metal content sludge. It is planned to monitor the water level inside the vessels with a crane and weigh cell.

End-User: SNF Project, Wally Rutherford, Fluor Hanford (FH), (509) 372-2903; Fax (509) 372-3655, W_W_Wally_Rutherford@rl.gov

Site Technical Points-of-Contact: Bruce Makenas, Fluor Hanford (FH), (509) 376-5447, Fax (509) 376-8027, Bruce_J_Makenas@rl.gov; Jim Sloughter, Numatec Hanford Corporation (NHC), (509) 373-0591, Fax (509) 372-1542, James_P_Sloughter@rl.gov

DOE End-User/Representative Point-of-Contact: Steve J. Veitenheimer, DOE-RL, (509) 373-9725, fax (509) 373-9837, Steve_J_Veitenheimer@rl.gov